CLIMATE PROGRAM OFFICE

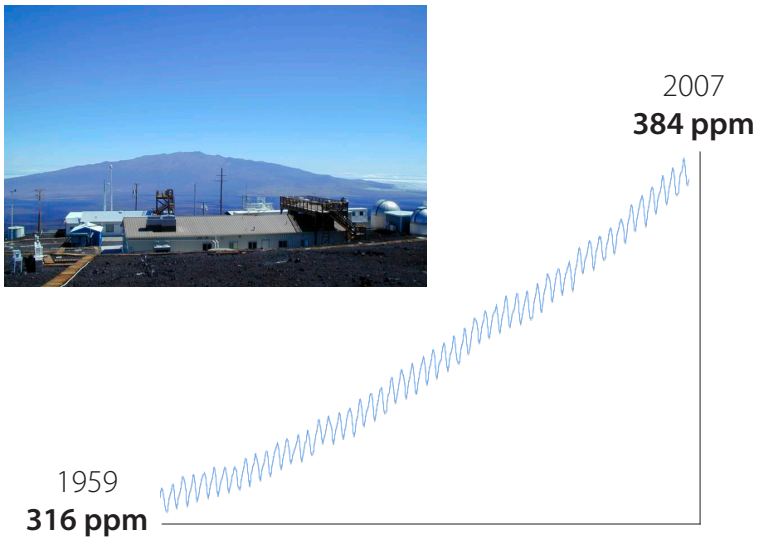
Atmospheric Climate Observations

How can we be sure that climate records used to measure change over time are reliable?

The Atmospheric Climate Observations (ACO) Program connects a global network of climate reference stations that employ rigorous standards for climate observations. Standards ensure that observations of surface and upper air temperature, precipitation, upper air water vapor, surface radiation, and chemical composition (for example, carbon dioxide and other trace gases) are consistent across stations and over time. The Program expands the global network of observation sites through collaborative agreements and by building new stations in underrepresented locations.

ACO Objectives

- Generate an improved, long-term, homogeneous surface and upper air climate record to better characterize climate variability and change.
- Increase value for and implementation of reference-quality standards for observations, involving station siting as well as data management and archiving procedures.
- Support a global network of robust and sustainable atmospheric climate observation stations.
- Establish new observation sites in data-sparse locations such as high elevations and high latitudes.



Measurements of atmospheric carbon dioxide concentration have been gathered at Mauna Loa Observatory in Hawai'i for 50 years. The monthly record shown here reveals seasonal changes as well as a steady increase over time.

Approaches

The Atmospheric Climate Observations (ACO) Program works to organize and integrate existing major climate reference systems into the program. These systems include individual networks as well as suites of networks, covering the globe at the surface and in the upper atmosphere. The Global Observing Systems Information Center, also known as GOSIC, is operated by NOAA's National Climatic Data Center (NCDC) on behalf of the global observing community. This center serves as the formal Global Climate Observing System (GCOS) data portal for atmospheric, oceanic, and terrestrial climate observations from across the world.

ACO also establishes partnerships to upgrade existing stations and install new stations to monitor international, national, and regional climate. These stations collect high-quality surface air temperature and precipitation measurements on an hourly basis. They also collect daily

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Approaches (continued)

measurements of water vapor in the upper atmosphere, a key climate-influencing factor that requires specialized observations. Finally, daily measurements of surface radiation, as well as chemical constituents, are made at a number of stations and observatories around the world.

Collaboration with other NOAA Facilities

The ACO Program works closely with various groups at NOAA's National Climatic Data Center, Earth System Research Laboratory, and Air Resources Laboratory. These collaborations tap into expertise across a range of NOAA facilities, advancing efforts to characterize baseline surface radiation, measure trace gases, and assure the quality of global precipitation chemistry measurements. NOAA lab capabilities also contribute to ACO's efforts to establish, maintain, and implement new scientific methods and algorithms associated with the U.S. Climate Reference Network program.

NOAA / OAR / Air Resources Laboratory

The 114th site of the United States Climate Reference Network, installed at Coos Bay, Oregon, in August 2008, was the final station established in the continental U.S.

ACO Highlights

50th Anniversary of the "Keeling Curve" Dataset

In 1957, as a scientist participating in the International Geophysical Year, Dr. Charles David Keeling of the Scripps Institution of Oceanography began taking detailed measurements of carbon dioxide concentration at the Mauna Loa Observatory on Hawai'i. The resulting dataset has become known around the world as the "Keeling Curve." In December 2007, NOAA celebrated the 50th anniversary of this important dataset.

At the time of Keeling's initial efforts, little was known of carbon dioxide in the atmosphere and no reliable atmospheric record existed. Indeed, many scientists were not certain that one could detect meaningful patterns in seasonal changes, hemispheric differences, and fossil fuel emissions by measuring such a low-concentration constituent of the atmosphere. We now use these records routinely to improve our understanding of the Earth system as a whole. The early observations inspired the establishment of a coordinated global monitoring network involving scientists and agencies around the world. Information derived from this network has been crucial for informing national and international assessments of global climate change, including the Intergovernmental Panel on Climate Change (IPCC).

Today, Keeling's measurements are still being made. They have been augmented substantially by NOAA and others since the 1970s, with parallel continuous or weekly measurements of a range of atmospheric constituents being made at a global network of over 60 sites. International partners from all continents and many islands contribute to this network of measurements as well, under the umbrella of the World Meteorological Organization. Measurements made as part of this network are subject to stringent quality control procedures and are archived in globally distributed repositories, including the World Data Centre for Greenhouse Gases in Japan and the Carbon Dioxide Information and Analysis Center at Oak Ridge, Tennessee.

Final U.S. Climate Reference Network Station Installed in the Continental United States

Partners involved with the ACO Program achieved a significant milestone in September 2008 as they initiated operations of the final continental U.S. site in the 114-station United States Climate Reference Network (USCRN). This network fulfills the need for robust climate observations necessary to document long-term climate trends for the Nation. The ACO program will now work to meet the challenge of continuing the thorough maintenance of all sites, assuring that the network can continue to record accurate climate records over the next 50-100 years.

In 2009, the USCRN is scheduled to expand into the state of Alaska, implementing 29 stations across the state over the next several years. The program will also install instruments at 40-60 existing network stations to measure soil moisture, soil temperature, and relative humidity. These measurements will serve as input to the National Integrated Drought Information System, NIDIS.